

TITLE OF THE INVENTION

EQUIPMENT AND PROCESS FOR MUSIC DIGITALIZATION, STORAGE,
ACCESS AND LISTENING

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BACKGROUND OF THE INVENTION

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The applicant is the assignee of the US patent 6.437.229, filed on 11.17.00 and granted on 08.20.02, and it relates to an EQUIPMENT AND PROCESS FOR MUSIC DIGITALIZATION, STORAGE, ACCESS, AND LISTENING, which equipment and process are to be employed in any commercial establishments trading CDs, in order to enable users to listen to all the songs from all the CDs available at the store.

Said equipment and process are based on the digitizing of the songs and their storage in a hard disk for later access and hearing.

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As a rule, they provide for one or more digital music servers (microcomputers where the songs from digitized CDs shall be stored), one or more music digitizing stations (microcomputers in charge of digitizing one passage of each song from each CD), and a number of listening stations (microcomputers through which the songs digitized in servers may be accessed and listened by users).

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Each listening station, provided with an earphone, a keyboard with display, and a bar code reader, communicates via local network with the servers.

Each CD is provided with a bar code tag that identifies it on an individual basis,
on an unmistakably way.

In proceeding with its studies, the Applicant developed now improvements to
said equipment and process for music digitalization, storage, access, and listening, which
improvements are employed in the digital music server, the music digitizing station, and
listening stations.

SUMMARY AND OBJECTS OF THE INVENTION

So, pursuant to these improvements, when the user desires to listen to some song
from a particular CD, the same shall have only to pass the bar code of said CD by the bar
code reader in a listening station, by which the information of artist and title, and the song
files of such CD, are quickly located. The first song file available is then sent to the listening
station, which starts its reproduction (play) in the earphone. Following, using the keyboard
and display, the user selects the desired track, and controls sound volume.

Likewise, pursuant to these improvements, the song file selected is downloaded
in small blocks to the listening station, on demand of the latter, which starts its reproduction
(play) as soon as the first block is received. So, the user starts to listen the song in the
earphone from the listening station, without having to wait for the whole file downloading.
The listening station automatically requests the next song file block, in a manner that
reproduction is not interrupted.

Likewise, pursuant to these improvements, the local server is provided with a
control software that controls the listening stations' entire operation through commands and
messages determined between it and the listening stations, which control software embodies

a function that allows certain listening stations, on a configurable basis, to reproduce only particular CDs.

Another innovation introduced by these improvements consists in using one central (or remote) digital music server.

5 Besides, another innovation consists in using a “download” software that brings from the central (or remote) server, the information in the CD and its song files, as regards CDs not existing in the local server and that have been requested for listening at the listening stations.

10 Pursuant to these improvements, the equipment is provided with a maintenance software for the local server, installed in the local server itself, and with a maintenance software for the central (or remote) server, installed in the digitizing station.

15 Formerly, the local server maintenance software was installed in the digitizing station; then said local server maintenance software was transferred to the local server itself, because in the equipment hereby improved, the local server is a mandatory one, while the digitizing station is optional.

So, the maintenance software executed in the song digitizing station is the “central (or remote) server maintenance software”, and the maintenance software installed in the local server is the “local server maintenance software”.

20 In fact, both the “local server maintenance software” and the “central (or remote) server maintenance software” may be installed in the local server or in the digitizing station; however, it is more logic to install the “local server maintenance software” in the local server, once it may exist a system without the digitizing station in the local network (notwithstanding the local server always exists), and the “central (or remote) server

maintenance software” in the digitizing station, once such station may play the role of the station that carries out the digitizing and accesses the central (or remote) server for updating data related to digitized CDs.

5 The central (or remote) server maintenance software installed in the digitizing station has the function of providing maintenance in the table of CDs and song files of the central (or remote) server, in a manner analog to that of the local server maintenance software embodied in the local server itself.

10 Likewise, pursuant to the improvements in question, the local server is provided with a software for updating the statistic data (statistic upload software), the function of which is to input the listening stations’ usage statistic data in the central (or remote) server.

Also pursuant to these improvements, the digitizing station is further provided with a data updating software (upload software), which enables the central (or remote) server to be updated with the information and song files of the CDs digitized and recorded in the local server or in the digitizing station itself.

15 Based on the simplicity and low cost philosophy, this invention implements the listening station through an architecture different from those in the existing systems in the market, where, among other important features, we may emphasize the local network interface embodied to the listening station.

20 Basically, the listening station started to be formed by dedicated apparatuses using a microcontroller, memory, components for audio decoding, digital/analog conversion, serial and parallel communication, network interface, among others. By these means, the cost and physical size of the listening station have been drastically reduced in comparison with the conventional implementation through compatible microcomputers and boards. In

addition to that, the listening station became practically immune from constant alterations due to the very dynamic evolution of motherboard, processor and boards compatible with the PC microcomputer.

Another advantage provided by the listening station of this invention is the possibility of installing a higher and better distributed number of listening stations throughout the commercial establishment, due to its smaller physical size and an easier installation.

With all of those advantages, this invention enables users to listen to all songs from all CDs available at the stores, in a manner substantially simpler, faster, and cheaper than the solutions normally employed for such a purpose.

BRIEF DESCRIPTION OF THE DRAWINGS

A more complete appreciation of the present invention and many of the attendant advantages thereof will be readily understood by reference to the following detailed description when taken in conjunction with the accompanying drawings, in which:

Figure 1 is a block diagram, schematically illustrating the equipment/process components hereby innovated (for illustration and description purposes only one (1) music server and one (1) music digitizing station are shown, but the system allows more than one (1) music server and more than one (1) music digitizing station, as well as it allows that only one microcomputer is the music server and the digitizing station at the same time);

Figure 2 illustrates the hardware block diagram of the listening station;

Figure 3 is a flow chart of the music digitizing station, illustrating the sequence of operations for conducting music digitizing and storage at the music server hard disk;

Figures 4 and 4A represent, on a continued basis, the music server flow chart;

Figures 5 and 5A represent, on a continued basis, the listening station flow chart, illustrating the sequence of operations for the user to access and listen the desired songs;

Figure 6 is a flow chart of the central (or remote) server updating software (upload software), illustrating the basic sequence of operations for updating the central (or remote) server with CDs digitized and recorded in the local server or, eventually, in the digitizing station itself, in the event it is not in the local network environment of the listening stations and local server; and

Figure 7 is a flow chart of the software (download software) that brings, from the central (or remote) server, the information in the CD and its song files for CDs not existing in the local server, and which have been requested for listening at the listening stations, or which are included in a list of CDs to be brought in a preset time, illustrating the basic sequence of operations.

DETAILED DESCRIPTION OF THE INVENTION

The subject matter of this Invention patent relates to an equipment and process for music digitalization, storage, access and listening, which equipment, as contained in the US patent 6,437,229 of the same Applicant, and pursuant to the schematic illustration of the block diagram in figure 1, is formed by a digital music server (1), one music digitizing station (2), and a variable and convenient number of listening stations (3), the latter being

interlinked to the server (1) and to the station (2) by a local network (4), said digital music server (1) being a high capacity hard disk microcomputer for storing the digitized songs, and to centralize, in a database, all of the information in the digitized CDs.

The digitizing station (2) is a microcomputer provided with a CD-ROM reader and, as an option, with a bar code reader, destined for digitizing a passage (preferably the thirty initial seconds) from each track of an audio CD, converting it in a digital coded file, and recording it in the digital music server (1). Therefore, it is provided with a software that allows music control and digitalization. For each digitized audio CD, a record with the CD information is made in said server database (1). Eventually, in situations where the number of CDs to be digitized is very big, options for using more than one digitizing station may be developed.

Pursuant to these improvements, the local digital music server (1) is provided with a control program (software) that controls the entire listening stations' operation by means of commands and messages determined between it and the listening stations. So, such a software recognizes and accepts the connection request from each listening station, sends initial commands such as "remove cursor", "clean display", "light display up", send the message "Read the bar code", receives the bar code, accesses the database for obtaining information concerning the CD the bar code of which has been received, sends command for adjusting the initial volume and, at the same time, for showing the artist, track number, time elapsed and sound volume on the display, sends the song file in blocks, so long it is requested by the listening station, sends the time elapsed each second for it to be shown on the display, sends, from time to time and alternatively, to be shown on the display, the artist, title, CD number (should there be more than one CD with the same bar code) and the price

(if available). From that moment on, the server software is ready to receive asynchronous messages from the listening station, which may be “song end”, time when it shall send the file corresponding to the next track (if it is not the last one), “next track key”, when it shall send the command for stopping the current song (in the case it is reproducing any), and promptly upon send the file corresponding to the next track (which may be the first track, in the case it is already playing the last track of the CD), “previous track key”, when it shall send the command for stopping the current song (in the event it is reproducing any), and promptly upon send the file corresponding to the previous track (which may be the last track if it is already playing CD first track), “stop key”, when it shall send the command for stopping reproduction (if it is reproducing any), “volume+ or volume- key”, when it shall send a command for adjusting (increase or decrease) the volume and, at the same time, show the value of the new volume on the display, and “bar code”, when it shall operate as formerly described.

As another innovation, this local server control software (1) embodies a function that allows certain listening stations (3), in a manner capable of configuration, to reproduce only particular CDs. The purpose of this function is to meet the need of certain stores to promote, together with recorders, certain CDs launches. In such a case, these listening stations (3) do not accept others CDs’ bar code.

Moreover, that local server (1) also started to embody a local server maintenance program (software) that allows the exclusion of CDs or song files corresponding to digitized tracks, the updating of data related to the CDs in the database, the listing of digitized CDs, the generation of a summary of the changes made during a determined date period for similar systems in other locations be able to be updated, the updating of the local system

through changes conducted in a system in other location, the listing of statistics of access to CDs by listening stations, so as to be possible to know, for instance, which were the more accessed tracks or CDs within a time period, or to know which were the more used listening stations 3, and to obtain the automatic system updating through an autoexec CD-R containing input and output data from CDs and respective song files.

Also pursuant to these improvements, a central (or remote) digital music server (1A) is further provided (see figure 1 again), which is also a microcomputer with a large capacity hard disk destined to store the digitized songs, and to centralize, in a database, all information in the digitized CDs. Said central (or remote) server (1A) may be accessed by local servers (1) and by digitizing stations (2), via WAN (wide area network) or via Internet (4A).

Another innovation introduced in the local server (1) was the embodiment of a download program (software), which brings from the central (or remote) server (1A) the information in the CD and its song files, for CDs not existing in the local server (1) and that have been requested for listening at the listening stations (3). That software also enables the search, in said central (or remote) server (1A), in a preset time, of all CDs the bar codes of which are enrolled in a list available in the local server (1).

Also as to the innovation in the local server (1), it is provided with a program for updating statistic data (statistic upload software), the function of which is to input the statistic data of the listening stations usage (3), collected and stored in the local server (1), into the central (or remote) server (1A). That software automatically sends the statistic data to the central (or remote) server (1A) in a preset time, provided that data already sent in previous times shall not be sent any longer and may be discharged from the local server (1).

One advantage in having the statistic data in the central (or remote) server (1A) is that since all data are centralized, it is easier to generate comparative reports involving more than one store.

So, in accordance with these improvements, the central (or remote) server concept (1A) was included, the purpose of which is to be a repository for all digitized CDs. It is, therefore, a central server that may be accessed by the local servers (1) of the stores, and also by digitizing stations (2), via WAN (wide area network) or via Internet (4A), in order to bring to the stores the CDs demanded by users, and also to update the central server with the CDs digitized in the digitizing stations located in the local network environment of stores or their locations.

Moreover, pursuant to these improvements, the digitizing station (2) is also provided with a program for updating the data (upload software), which enables to update the central (or remote) server (1A) with the information and song files in CDs digitized and recorded in the local server (1) or in the very digitizing station (2). That software allows the immediate updating, as soon as a CD is digitized, or the updating in a preset time. It may also check whether a CD is already present in the central (or remote) server (1A), and by then not carry out the updating, or to update regardless such a fact. So, the digitizing station (2) may be also used as a dedicated station, in order to input the new CDs launches into the central (or remote) server, and, by then, be in a local network different from the local network where the listening stations (3) and the local server (1) are.

A third program constitutes the digitizing station (2) suite of software: the central (or remote) server maintenance software. Such software has the function of providing

maintenance in the table of CDs and song files of the central (or remote) server (1A), in a manner analog to the maintenance software embodied in the local server (1).

Also pursuant to these improvements, and as illustrated in the block diagram shown in figure 2, the listening stations (3) are hardware and firmware apparatuses (microcontroller program) consisting of modules, the module A consisting of an interface for keyboard/display (5), where the keyboard and the LCD are connected, a serial interface (6), where the bar code reader(scanner) is onnected, a microcontroller (7), which is the processing unit that executes the instructions of the firmware contained in the internal flash memory, a local network interface (8), where an Ethernet local network (4) is connected, and a RAM (9) used by the firmware as a data area. The module B consists of a keyboard (11), a LCD (12), a bar code reader (scanner) (13), and an earphone (14), and constitutes an independent physical module because it is in direct contact with the user. The module C consists of the audio decoder, digital/analog (D/A) converter, and the amplifying circuit for stereo audio output; the earphone (14) of the module B is connected to this module C. And the module D is a power supply that provides the required voltages to modules A, B, and C, and has a power supply cable (10).

Unlikely of the microcomputer, which requires an operation system and drivers, further to the application *per se*, this hardware apparatus requires, for it to operate, only a program (firmware) that controls the resources of the hardware, and which communicates with the server program. The listening station firmware is responsible for requesting the TCP connection with the server, receive asynchronous messages from the bar code reader (CD bar code), the keyboard (“next track”, “previous track”, “stop”, “volume+” and “volume-”), and from the audio module (“song end”), and to send them to the server program, receive

and execute commands sent by the server program, such as, “remove cursor from the display”, “clean the display”, “light up the display”, “enable the keyboard”, “shown the message on the display”, “adjust the volume and show the message on the display”, “store song block and start reproduction”, “store song block”, “stop song reproduction”, etc.

5 The final user has access only to the bar code reader, the keyboard, the display, and the earphone (Module A). The communication of the hardware apparatus with the bar code reader is made through serial ports RS-232C, RS-485, or USB, and with the keyboard by the keyboard interface. The sound is played in the earphone by module B, which contains the audio decoder, digital/analog converter, and output amplifier. The earphone can be of the
10 conventional type usually found in the market, but it must be provided with a steel-coil protection for preventing steals and vandalism attitudes. The bar code reader can be a laser scanner with line scanning, or a CCD technology scanner, and the keyboard may be embodied as an apparatus with simple keys, provided with keys enough to allow the user to control track selection (forward and reward), the sound volume (increase and decrease) and
15 also reproduction interruption. Eventually, the keyboard may have more keys allowing other functions.

 Local network bandwidth (4) should preferably be around 100 Mbps, taking into account the distance between the listening stations (3) and the local server (1). In case of very long distances, complementary equipment may be required.

20 The local network can be implemented by cables with conducting and connecting wires linking the involved equipment, or even by an electromagnetic wave communication means.

Figure 3 is a flow chart of the music digitizing station (2), illustrating the sequence of operations for carrying out music digitizing and storage on server's hard disk (1), exactly as occurs in the former US patent 6.437.229, and described herein in order to help the understanding of the equipment and process hereby improved.

5 Thus, the process starts by inserting an audio CD, in step E1, and all tracks are automatically selected for digitalization. In step E2, a number corresponding to the CD bar code is provided. In step E3, a decision is made as to whether additional information in the CD (artist and title) shall be included. If so, CD additional information is input in the step E4.

10 Once such information is input to the system, or if no additional information is to be input, it goes to the next step E5, where the beginning and duration of the music passage to be digitized is specified. In step E6, the CD bar code number and, if any, additional information thereon, is entered into the digital music server (1), starting the digitizing process for all tracks of the inserted CD.

15 In step E7, the digital reading of the first selected track is made, coding it in compacted form, recording it, promptly upon, in the digital music server (1), the resulting file bearing the name formed by the bar code number and the track number.

 In step E8, a determination is made whether the last selected track has been digitized; if not, it returns to the step E7, reading the next selected track, its coding and
20 recording of the file in the digital music server (1). That step E7 is repeated for every track of the CD, until the last track has been digitized.

 When the answer for the step E8 is that the last track has been digitized, it goes to step E9, which determines whether the user desire or not to digitize another CD.

If yes, it returns to step E1. If not, the digitizing and storage process for a passage of all audio CD tracks is accomplished.

Figures 4 and 4A illustrate, one after the other, the flow chart of the local server program, subject matter of this improvement, illustrating the basic sequence of the operations carried out in the server for controlling a listening station, executing an operation cycle that includes from the TCP connection request up to the activation of keyboard keys, including the sending of the bar code, database access, and transmission of the song file.

In the initial step F1, it waits for the connection request from a listening station; when the request comes, it accepts it (step F2), which makes connection between the server and the listening station to be established. In step F3, it sends the commands “remove cursor”, “clean display”, “enable keyboard” and “light up display” to the listening station. Promptly upon, in step F4, it sends the command for showing the message “Read the code bar” on the display. From that point, it waits for a bar code sent by the listening station (step F5). When the bar code is received, it sends the command to show the message “Wait...” on the display (step F6).

In step F7, it checks whether the CD the bar code of which was received exists in the local server. Should the CD the bar code of which was received not exist in the local server, the message “not registered CD” is sent to a listening station (step F8), and, promptly upon, it checks whether that CD should be searched in the central (or remote) server (step F9). If not, the flow returns to step F4, where the message “Read the bar code” is sent. If yes, it checks if the CD should be immediately brought from the central (or remote) server (step F10). If the CD has not to be immediately brought, the information in the CD is saved in a list of CDs to be brought by the download software in a preset time (step F11), and the flow

returns to step F4. If the CD has to be immediately brought, it sends an advice together with the required information to the download software for it to search the CD in the central (or remote) server (step F12), after what the flow proceeds in step F4.

5 If the CD the bar code of which exists in the local server, the database is accessed (step F13) and all information associated to the bar code received.

Next, in step F14, it sends the command for adjusting the sound volume and to show, at the same time, the message formed by artist, track number, elapsed reproduction time and volume value on the display. In step F15, it obtains the song file and sends a command for storing the first block (with this block aggregated) and, at the same time, for starting song reproduction (play). In step F16, it waits for the message requesting the next
10 block sent by the listening station. When such message is received, it checks whether there is a next song block to be sent (step F17). If so, it sends the command for storing the aggregated song block (step F18) and returns to step F16. If there is not any other block to be sent, it sends the command “no more song blocks” (step F19) and proceeds in step F20,
15 where it waits for some asynchronous message from the listening station.

If an asynchronous message comes, it checks whether this message is the “bar code” (step F21). If it is the bar code, it sends a command for stopping song reproduction (step F22), and it comes back to step F6. If it is not a bar code, it checks whether it is “song end” (step F23). If it is “song end”, it returns to step F4. If it is not “song end”, it checks
20 whether it is “stop” (step F24). If it is “stop”, it sends the command for stopping song reproduction (step F25), and returns to step F4. If it is not “stop”, it checks whether it is “next track” or “previous track” (step F26). If it is “next track” or “previous track”, it sends a command for stopping song reproduction (step F27), and subsequently, in step F28, it

sends a command for showing the artist, the number of the track corresponding to the next track or previous track, the reproduction time elapsed and the volume value on the display, and it returns to the step F15. If it is not “next track” or “previous track”, it checks whether it is “volume+” or “volume-” (step F29). If it is “volume+” or “volume-”, it sends, in step 5 F30, a command for adjusting the new volume value, increasing (if it is “volume+”) or decreasing (if it is “volume-”) and, at the same time, to show such value on the display, proceeding the flow in step F31. If it is not “volume+” or “volume-” (step F31), it checks whether the asynchronous message is a request for updating the reproduction time elapsed. If yes, it sends a command for showing the updated elapsed time (which value is aggregated 10 to the command) on the display (step F32) and it returns to step F20. If not, it directly returns to step F20.

Figures 5 and 5A illustrate, one after the other, the flow chart of the listening station program, which is also a subject of this improvement, illustrating the basic sequence of the operations comprehended in an operation cycle that includes from the TCP connection request, up to the activation of the keyboard keys, including the bar code sending, song file receipt, and song reproduction. 15

In the initial step (step G1), a connection request is made with the server. In the next step (step G2), if the connection is accepted, it goes to the next step (step G3), where it waits for a command from the server. If the command comes, it checks whether it is 20 “stop”, “remove cursor”, “clean display”, “enable keyboard”, “light display up”, “adjust the volume” or “show message” (step G4).

If so, in step G5, it executes the command received; promptly upon, in step G6, it checks whether there is an asynchronous message to be sent to the server; if yes, it sends

that message (step G7) and returns to step G3; if there is no asynchronous message, it returns to step G3.

If the received command is not one of those aforementioned, it checks whether it is “send the bar code” (step G8). If it is “send the bar code”, it checks, in step G9, whether there is a bar code to be sent; if any, it sends (step G10) and returns to step G3. If not, it waits for a bar code (step G9).

If it is not “send bar code”, it checks whether it is “store the first song block and start reproduction” (step G11). If it is not, it checks whether it is “store song block” (step G12); if so, it executes the received command (step G13) and goes to step G16; if it is not “store the song block”, it checks whether the command is “no more song blocks” (step G14); if so, it goes to step G16, and if it is not, it returns to step G6. If the received command is “store the first song block and start reproduction”, it executes the received command (step G15), and follows to step G16, where it checks whether there is an asynchronous message to be sent to the server. If there is not an asynchronous message, it continues in step G16, waiting for some asynchronous message. If there is an asynchronous message, it follows to the next step (step G17), where it checks whether that message is “update the elapsed reproduction time”. If so, it sends that message to the server in step G18, and waits for a command from the server, in step G19. In that step, if a command comes from the server, it executes it in the next step (G20), after which it returns to step G16. If the pending asynchronous message is not “update the elapsed reproduction time”, it checks whether it is “volume+” or “volume-” (step G21). If so, it sends the asynchronous message to the server (step G22) and waits for a command from the same (step G23). If the command comes from the server, it executes it (step G24) and returns to step G16. If the asynchronous message is

not “volume+” nor “volume-”, it sends this message to the server (step G25) and returns to step G3.

Figure 6 is a flow chart of the central (or remote) server updating program (upload software), illustrating the basic sequence of operations for updating the central (or remote) server (1A) with CDs digitized and recorded in the local server (1) or, eventually,
5 in the digitizing station (2) itself, in the event it is not in the local network environment of the listening stations and local server.

In step H1, it checks whether there is any CD digitized in the local server or in the digitizing station that should be sent to the central (or remote) server. If any, the
10 information in the CD and its song files are sent to the central (or remote) server in step H2, after which it returns to step H1. If not, it verifies, in step H3, whether the preset time was reached. If not, it returns to step H1. If yes, it checks, in step H4, whether there is a CD in the list of CDs to be sent to the central (or remote) server in the preset time. If not, it returns to step H1. If yes, it proceeds executing step H2.

15 Figure 7 is a flow chart of the program (download software) that brings, from the central (or remote) server, the information in the CD and its song files for CDs not existing in the local server, and which have been requested for listening at the listening stations, or which are included in a list of CDs to be brought in a preset time, illustrating the basic sequence of operations.

20 In step I1, it checks whether there is a CD to be immediately brought from the central (or remote) server. If yes, it checks, in step I2, if the CD to be brought is present in the central (or remote) server. If it is not present, in step I3, the data of the CD in the list of CDs to be brought in a preset time are saved, and it returns to step I1. If it is present, in step

I4, it brings the information in the CD and its song files from the central (or remote) server, and the same are recorded in the local server; having it been done, it returns to step I1. If, in step I1, there was not a CD to be immediately brought, it follows to step I5, where it checks whether the preset time was reached. If not, it turns to step I1. If yes, it checks, in
5 step I6, whether there is a CD in the list of CDs to be brought from the central (or remote) server. If there is not, it returns to step I1. If any, it proceeds executing step I4.

While the invention has been described in its presently preferred form, it is to be understood that there are numerous applications and implementations for the present invention. Accordingly, the invention is capable of modification and changes without
10 departing from the spirit of the invention as set forth in the appended claims.

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